

**CLAIMS**

1. A control apparatus for an adaptive adjustment of the input polarization to a polarization-maintaining waveguide component,  
5 comprising:

a polarization control unit controlling a polarization state of an input light to the polarization-maintaining waveguide component according to an input signal fed back from an output side of the polarization-maintaining waveguide component so that  
10 a polarization of an input light to the polarization maintaining waveguide component matches to a principal axis of polarization of the polarization maintaining waveguide component;

a polarization monitor unit monitoring the polarization state at an output of the polarization-maintaining waveguide  
15 component and feeding back a monitoring result to the polarization control unit as the input signal.

2. The control apparatus according to claim 1, wherein  
the polarization monitor unit further monitors an  
20 existence or disappearance of an optical signal traveling through the polarization-maintaining waveguide component.

3. The control apparatus according to claim 1, wherein  
the polarization monitor unit comprises a polarization  
25 beam splitter, the polarization beam splitter is aligned to the

polarization-maintaining waveguide component so that the light with the polarization state which matches to the principal axis of the polarization-maintaining waveguide component couples to the through-port of the polarization beam splitter and a light  
5 of a drop-port is used for polarization state monitoring.

4. The control apparatus according to claim 3, wherein  
a plurality of the polarization control units are provided  
for an equal number of wavelengths included in the input light,  
10 a tunable wavelength filter is provided after the  
polarization beam splitter along a feedback path, and  
each of the plurality of the polarization control units  
controls a polarization state of the input light for each  
wavelength based on a feedback signal obtained by detecting a  
15 power of a light passing through the tunable wavelength filter.

5. The control apparatus according to claim 3, wherein  
a plurality of the polarization control units are provided  
for an equal number of wavelengths included in the input light,  
20 a wavelength demultiplexing unit is provided after the  
polarization beam splitter along a feedback path and  
demultiplexing an input light into each wavelength, and  
each of the plurality of the polarization control units  
controls a polarization state of the input light for each  
25 wavelength based on a feedback signal obtained by detecting each

power of lights demultiplexed by the demultiplexing unit.

6. The control apparatus according to claim 2, wherein the polarization monitor unit comprises:

5 an optical power divider placed after the polarization-maintaining waveguide component,

a polarization selective unit connected to one port of the optical power divider with its polarization axis aligned to that of a principal axis of polarization of the polarization-maintaining waveguide component, and  
10

a monitoring unit connected to the polarization selective unit for optical power detection and providing a feedback signal to the polarization control unit.

15 7. The control apparatus according to claim 6, wherein the polarization selective unit is a polarizer with its through-axis aligned to a desired principal axis of the polarization maintaining waveguide component, and

the monitoring unit is a photodiode connected to an output  
20 of the polarizer.

8. The control apparatus according to claim 6, wherein the polarization selective unit is a polarizer with its through-axis aligned to a desired principal axis of the polarization maintaining waveguide component, and  
25

the monitoring unit is a tunable wavelength filter connected to an output of the polarizer.

9. The control apparatus according to claim 6, wherein  
5 the polarization selective unit is a polarizer with its through-axis aligned to a desired principal axis of the polarization maintaining waveguide component, and

the monitoring unit is a wavelength demultiplexer connected to an output of the polarizer.

10

10. The control apparatus according to claim 6, wherein  
the polarization selective unit is a polarization beam splitter and the monitoring unit includes two photodiodes connected to two outputs of the polarization beam splitter.

15

11. The control apparatus according to claim 6, further comprising an optical switch,  
wherein

the polarization selective unit is a polarization beam  
20 splitter and the monitoring unit, the optical switch is connected to output ports of the polarization beam splitter, and the monitoring unit includes a tunable wavelength filter connected to the output of the optical switch.

25 12. The control apparatus according to claim 6, further

comprising an optical switch,  
wherein

the polarization selective unit is a polarization beam  
splitter and the monitoring unit, the optical switch is connected  
5 to output ports of the polarization beam splitter, and the  
monitoring unit includes a wavelength demultiplexer connected  
to the output of the optical switch.

13. The control apparatus according to claim 2, wherein  
10 the polarization monitor unit comprises:
- an optical power divider placed after the  
polarization-maintaining waveguide component,
  - a wavelength selective unit connected to one port  
of the optical power divider,
  - 15 a polarization selective unit connected to the  
wavelength selective unit with its polarization axis aligned to  
that of a principal axis of polarization of the  
polarization-maintaining waveguide component, and
  - a monitoring unit connected to the polarization  
20 selective unit for optical power detection and providing a  
feedback signal to the polarization control unit.

14. The control apparatus according to claim 13, wherein  
the wavelength selective unit is a tunable wavelength  
25 filter and the polarization selective unit is a polarizer.

15. The control apparatus according to claim 13, wherein  
the wavelength selective unit is a tunable wavelength  
filter and the polarization selective unit includes a  
5 polarization beam splitter and photodiodes connected to the  
polarization beam splitter.

16. The control apparatus according to claim 13, wherein  
the wavelength selective unit is a wavelength  
10 demultiplexer and the polarization selective unit includes a  
polarization beam splitter connected to output ports of the  
wavelength demultiplexer and photodiodes connected to the  
polarization beam splitter.

15 17. The control apparatus according to claim 1, wherein  
the polarization monitor unit comprises:  
an optical power divider placed after the  
polarization-maintaining waveguide component, and  
a polarimeter analyzing the state of polarization  
20 and providing a feedback signal to the polarization control unit.

18. The control apparatus according to claim 1, wherein  
the polarization monitor unit comprises:  
an optical power divider placed after the  
25 polarization-maintaining waveguide component,

a tunable wavelength filter connected to one output port of the optical power divider, allowing monitoring one of a plurality of wavelengths, and

a polarimeter analyzing the state of polarization and providing a feedback signal to the polarization control unit.

19. The control apparatus according to claim 1, wherein the polarization monitor unit comprises:

a power divider unit connected after the polarization maintaining waveguide component, and

a spectrum monitor unit connected to one of the output ports of the power divider, analyzing spectrum of a received light, and generating feedback signal to the polarization control unit.

15

20. The control apparatus according to claim 19, wherein the spectrum monitor unit is an optical spectrum analyzer.

21. The control apparatus according to claim 19, wherein

the spectrum monitor unit includes a wavelength selective filter and a photodiode detecting the power of the light passing through the wavelength selective filter.

22. The control apparatus according to any one of claims 19

through 21, wherein

a plurality of the polarization control units is provided for each wavelength and a wavelength multiplexed light is inputted to the polarization maintaining waveguide component.